

## 中国南部长臂猿的分类与分布 ——附三个新亚种的描述\*

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关键词 长臂猿 分类 新亚种 中国南部

长臂猿 (Gibbons) 系灵长类 (Primates) 中严格营树栖生活的较高级的一个类群。以前肢长于后肢及无尾为其特征, 在灵长类中占有独特的分类地位, 且仅分布于亚洲东南部的热带、南亚热带地区。迄今已知现生长臂猿共 9 种另 12 亚种。

过去, Anderson (1879); Thomas (1892); Allen (1938); Ellerman & Morrison-Scott (1951); 李致祥等 (1983) 等先后报道中国南部及邻近地区有长臂猿 3 种另 2 亚种\*\*:

1. 白掌长臂猿 *Hylobates lar carpenteri* Groves
2. 黑长臂猿 *Hylobates concolor* Harlan
  - (1) 黑冠长臂猿 *H. c. concolor* Harlan
  - (2) 白颊长臂猿 *H. c. leucogenys* Ogilby
  - (3) 海南长臂猿 *H. c. hainanus* Thomas
3. 白眉长臂猿 *Hylobates hoolock leuconedys* Groves

最近, 我们对昆明动物研究所历年来所收藏的长臂猿标本作了进一步清理, 发现以往对中国南部及其邻近地区长臂猿的分类还存在一些问题, 有进一步探讨的必要。

本文对 40 余号长臂猿标本作了详细的对比, 并参照国内外有关文献进行分析认为: 中国南部及其邻近地区的长臂猿应为 4 种另 3 亚种。其中包括白颊长臂猿 (*Hylobates leucogenys*) 种级地位的恢复和三个新亚种。现分述如下:

\* 承全国强同志提供资料, 解宏同志协助测量头骨, 谨此致谢。

本文长度单位为毫米 (mm), 重量为千克 (kg)

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\*\* 《CHINA DAILY》(1983) 报道云南西部沧源县有合趾长臂猿 (*Hylobates syndactylus*) 生存。后经笔者前往该处作实地调查, 证明该合趾猿为短尾猿 (*Macaca arctoides*) 的误判, 应予澄清。据 Groves (1972, 1984) 记载, 合趾长臂猿仅见于苏门答腊 (Sumatra) 和马来亚 (Malaysia) 西部。

## 白颊长臂猿 (*H. leucogenys*) 与黑长臂猿 (*H. concolor*) 的种级分类地位问题

白颊长臂猿 (*H. leucogenys*) 由Ogilby (1840) 根据泰国标本命名之后, 曾一直被视作一独立种 (Elliot, 1912; Allen, 1938)。1951年, Ellerman & Morrison-Scott 将其并入黑长臂猿 *H. concolor* 作为一个地理种群 (*H. c. leucogenys*), 此后均予沿用。今经将 *H. leucogenys* 与 *H. concolor* 作详细比较, 发现两者实有明显区别 (表1)。其主要差异如下:

1. *H. leucogenys* 的雄性面颊毛色浅, 由纯白、黄白到粉红色, 与体毛色形成鲜明的对比; 而雄性 *H. concolor* 通体连同颊部均一致的纯黑色。

2. *H. leucogenys* 上犬齿较尖长而锐利, 齿沟模糊不清或完全缺乏; *H. concolor* 则较粗钝, 齿沟长而深凹。

3. 两者白齿大小的顺序各不相同。白颊长臂猿为  $M^2 > M^1 > M^3$ , 黑长臂猿则  $M^2 > M^1 \approx M^3$  (量度见表1)。

4. 两者的阴茎骨 (Penis bone) 差别较大。*H. leucogenys* 的阴茎骨细长呈条状 (8—10 mm), 端部稍弯曲, 常分为两叶。黑长臂猿 *H. concolor* 的则较粗短 (6—9 mm), 呈圆锥形, 基部粗、前端细, 直而不弯曲, 尖端有一细小浅沟 (图1)。

*H. leucogenys* 与 *H. concolor* 不仅形态差异较大, 而且在动物地理学上两者具有同域分布现象。我们曾在绿春黄连山一带 (云南南部) 得到过这两种长臂猿的标本。在越南北部的马江 (Ma River) 两岸地区, 两者同域分布现象更为普遍 (Dao Van Tien, 1983)。

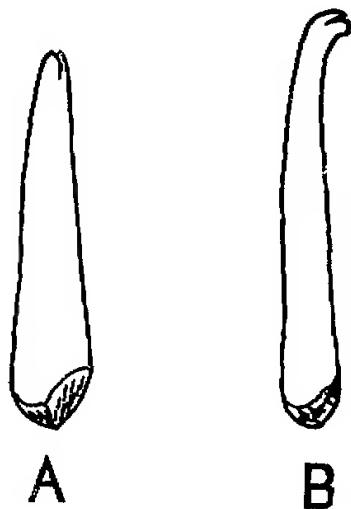


图1 白颊长臂猿和黑长臂猿的阴茎骨

Fig. 1. The penis bones of *Hylobates leucogenys* and *Hylobates concolor*.

A. 黑长臂猿 *H. concolor*.

B. 白颊长臂猿 *H. leucogenys*.

表 1 白颊长臂猿与黑长臂猿的比较

Table 1. The comparison of *Hylobates leucogenys* with *Hylobates concolor*

种 名 Specific name	白 颊 长 臂 猿 <i>Hylobates leucogenys</i>		黑 长 臂 猿 <i>Hylobates concolor</i>	
项 目 Item	15♂♂	4 ♀♀	10♂♂	11♀♀
体 型 Body size	较 小 Lesser	较 大 Bigger	较 大 Bigger	较 小 Lesser
体 背 色 Colour on back	灰 黑 Grey black	淡黄或黄褐 Light yellow or yellow-brown	亮 黑 Light black	灰黄或亮黄 Grey or light yellow
体 腹 色 Colour of belly	灰 黑 Grey black	黑毛较少 Black hair fewer	暗 黑 Dark black	黑毛多或无 Black more or no
冠 毛 色 Crown hair	灰 黑 Grey black	暗 褐 Dark brown	亮 黑 Light black	黑褐或亮黑 Black brown or light black
体 毛 Hair of body	较 粗 Coarser	较 粗 Coarser	较 细 Slender	较 细 Slender
颊 毛 Cheek hair	白 色 White	淡 白 色 Light white	黑 色 Black	白毛多或无 White more or no
额 骨 Frontal bone	较 低 Lower	较 低 Lower	较 高 Higher	较 高 Higher
鼻 骨 Nasal	宽 平 Wide & flat	宽 平 Wide & flat	狭 而 高 Narrow & higher	狭 而 高 Narrow & higher
上臼齿大小 M <sup>1</sup> -M <sup>3</sup> size	M <sup>2</sup> >M <sup>1</sup> >M <sup>3</sup> M <sup>1</sup> (6.6×6.4) M <sup>2</sup> (7.3×6.8) M <sup>3</sup> (6.2×5.9)	M <sup>2</sup> >M <sup>1</sup> >M <sup>3</sup> M <sup>1</sup> (6.3×6.7) M <sup>2</sup> (7.2×6.5) M <sup>3</sup> (6.7×5.6)	M <sup>2</sup> ≥M <sup>1</sup> ≈M <sup>3</sup> M <sup>1</sup> (6.6×6.4) M <sup>2</sup> (7.1×6.9) M <sup>3</sup> (6.7×5.9)	M <sup>2</sup> ≥M <sup>1</sup> ≈M <sup>3</sup> M <sup>1</sup> (6.5×6.0) M <sup>2</sup> (7.1×6.7) M <sup>3</sup> (6.7×5.8)
犬 齿 Canine	细 尖 Slender & pointed		粗 钝 Coarser & shield	
上犬齿沟 Upper canine groove	无或浅短(6-7) No or shallow & short		深 长(12-21) Deep & long	
阴茎骨 Penis bone	前端具骨突 With bone projection in front		前端无骨突 No bone projection in front	
阴茎骨长 Penis bone length	8-10		6-9	
颅 全 长 Greatest length of skull	115(112-122)		111(102-117)	
腭 长 Palatal length	44(42-48)		42(39-45)	
后 足 长 Hind foot	126(101-151)		146(135-165)	
体 重 Body weight	7.2(6.0-8.2)		7.8(6.9-10.0)	

所以,我们认为白颊长臂猿不应置于黑长臂猿*H. concolor*之下,而应恢复其原定种*H. leucogenys*的种级分类地位。Groves (1972, 1984), Dao Van Tien (1983)曾提出过*H. concolor*的三个白色(包括红色)颊毛亚种可能是另一个独立种的不同亚种。但因未发现头骨以外的差异而仍作为黑长臂猿的不同亚种处理。我们的研究结果表明,白颊长臂猿*H. leucogenys*和黑长臂猿*H. concolor*实为两个有效的独立种。

## 中国南部及邻近地区长臂猿的种类记述

(一) *Nomascus* 亚属 本亚属仅有两种。染色体二倍体数目 $2n=52$ 。

### 1. 白颊长臂猿 *Hylobates leucogenys leucogenys* Ogilby

*Hylobates leucogenys* Ogilby, 1840, *Proc. Zool. Soc.*, 20. (泰国)。

*Hylobates concolor leucogenys* Ellerman & Morrison-Scott, 1951, p. 212; 高耀亭等, 1962, p. 180; 李致祥等, 1983, p. 117; Dao Van Tien, 1983, p. 367; Groves, 1984, p. 547.

鉴别特征: 体型中等。雄性体毛灰黑色, 面颊具纯白或黄白色长毛(35—47), 其毛尖远超过耳壳上缘。雌性体毛污黄或黄褐。头顶具暗褐色冠斑, 向后延伸达枕部或更远, 冠斑长约120—125。胸腹及四肢染少量黑毛。

标本及量度(表1、2)。

分类讨论: 白颊长臂猿*H. leucogenys*包括三个亚种: *H. l. leucogenys*; *H. l. siki*; *H. l. gabriellae*。后两亚种原亦归属于黑长臂猿*H. concolor*种下的地理亚种, 因两者雄性颊部都具有如前所述的浅色颊毛, 且有各自的分布区域。为此, 应属*H. leucogenys*的地理亚种。三个亚种中, 白色颊毛超过耳尖的为指名亚种*H. l. leucogenys*; 白色颊毛仅及耳的一半的为越中亚种*H. l. siki*; 而颊毛带粉红色的则为红颊亚种*H. l. gabriellae*。

地理分布: 中国云南南部及邻近地区的白颊长臂猿仅有*H. l. leucogenys*一个亚种, 见于元江以西的绿春和澜沧江以东的勐腊、江城一带。向东南可至老挝北部和越南西北部。而*H. l. siki*仅分布于越南中部, *H. l. gabriellae*只见于越南南部。

### 2. 黑长臂猿 *Hylobates concolor* (Harlan), 1826

*Simia concolor* Harlan, 1826, *J. Acad. Nat. Sci. Phil.* 5(4):231, Pls. 9 and 10. (模式产地可能是越南北部)。

鉴别特征: 体型大。雄性通体黑色, 颊毛亦黑色。头顶通常具亮黑色直立冠毛。雌性体毛浅黄、棕黄或亮金黄色。头顶具形态各异的黑褐色或亮黑色冠斑。冠斑长约105—130, 向后延伸至枕部或颈背。胸腹黑毛浓密或不具黑毛。

标本及量度(表1、2)。

亚种分化: 黑长臂猿为中国南部及其邻近地区分布最广的一种。依其形态差异可分为5亚种。中国南部及邻近地区共有下列4亚种。

表 2 中国南部四种长臂猿的测量

Table 2. The weights and measurements of four species of gibbons in southern China

项 目 Item	种 名 Specific name	黑 长 臂 猿 <i>H. concolor</i>	白 眉 长 臂 猿 <i>H. leucogenys</i>	白 掌 长 臂 猿 <i>H. lar</i>	白 眉 长 臂 猿 <i>H. hoolock</i>
		4 ♂♂, 5 ♀♀	5 ♂♂, 2 ♀♀	1 ♂, 3 ♀♀	4 ♂♂, 1 ♀
体 重 Body weight		7.8 (6.9—10.0)	7.2 (6.0—8.2)	4.5 (3.9—5.0)	7.2 (5.3—8.5)
体 长 Head & body		495 (430—540)	499 (470—525)	417 (370—505)	499 (445—578)
后 足 长 Hind foot		146 (135—165)	126 (101—151)	117 (106—125)	139 (126—153)
耳 长 Ear length		36 (28—40)	33 (28—41)	31 (30—32)	29 (21—33)
前 肢 长 Length of fore limbs		628 (550—780)	675 (610—740)	—	—
后 肢 长 Length of hind limbs		457 (410—510)	481 (440—510)	—	—
颅 全 长 Greatest length of skull		111 (102—117)	115 (112—122)	97 (88—105)	105 (101—109)
眉 脊 长 Superciliary ridge to end of occipital		86 (82—90)	86 (85—88)	72 (66—78)	74 (73—74)
后 头 宽 Mastoid width		68 (64—72)	69 (67—72)	65 (61—70)	62 (61—62)
腭 长 Palatal length		42 (39—45)	44 (42—48)	35 (30—41)	34 (31—37)
眶 间 宽 Interorbital breadth		12 (10—15)	13 (11—15)	9 (8—11)	9 (9—10)
颧 弓 宽 Zygomatic width		71 (66—75)	70 (60—75)	59 (53—65)	64 (57—70)
臼 齿 横 宽 Width across molars		35 (33—37)	36 (34—38)	31 (29—32)	32 (31—33)
枕 大 孔 长 Length of occipital foramina		20 (18—22)	19 (17—20)	13 (12—14)	17 (16—18)
下 颌 骨 长 Length of mandibular		74 (71—78)	74 (70—79)	67	63 (61—68)
下 颌 骨 高 High of mandibular		25 (21—27)	23 (19—27)	21 (19—24)	26 (22—30)
上 犬 齿 长 Upper canine tooth length		21 (16—24)	21 (17—24)	16	10
上 齿 列 长 Upper tooth row (I1-M3)		38 (31—44)	41 (38—43)	40	37

(1) 指名亚种 *H. concolor concolor* (Harlan), 1826

*Simia concolor* Harlan, 1826, *J. Acad. Nat. Sci. Phil.* 5(4); 231.

(模式产地可能是越南北部)。

*Hylobates concolor concolor* Ellerman & Morrison-Scott, 1951, p. 212; 李致祥等, 1983, p. 117.

*Hylobates concolor hainanus*, Dao Van Tien, 1983, *Jour. Hum. Evol.*, 12, p. 367—372.

鉴别特征: 体型大。雄性通体亮黑色, 具显著直立冠毛。雌性毛色浅灰黄, 顶斑黑色, 似四角星形, 向后延至颈背前部。胸腹黑毛较多而短。后肢甚短于前肢 (67.2%)。耳短, 约28毫米左右。

分类讨论: 指名亚种的模式标本产地迄今未予肯定, 过去曾被认为是海南岛或越南北部Tonkin (Pocock, 1927), 因而长期将该两地的黑长臂猿均视作指名亚种 *H. c. concolor* (Allen, 1938; Ellerman & Morrison-Scott, 1951)。李致祥等 (1983) 甚至将云南各地所产的黑长臂猿亦均列为这一亚种。经仔细对比, 海南岛和云南南部的黑长臂猿之间有明显差异。云南南部和越南北部的雄性标本有直立冠毛。雌性毛色主要为浅黄灰色而非棕黄色, 胸腹部有较多而短的黑褐毛, 四肢亦具黑褐色。雌性头顶冠斑黑色, 呈方棱形 (图2, A)。这些特征在海南标本上是不存在的, 两者应为不同地理亚种, 即海南黑长臂猿 *H. c. hainanus* 和云南南部及越南北部的指名亚种 *H. c. concolor*。越南北部Tonkin可能为本亚种的模式标本产地。

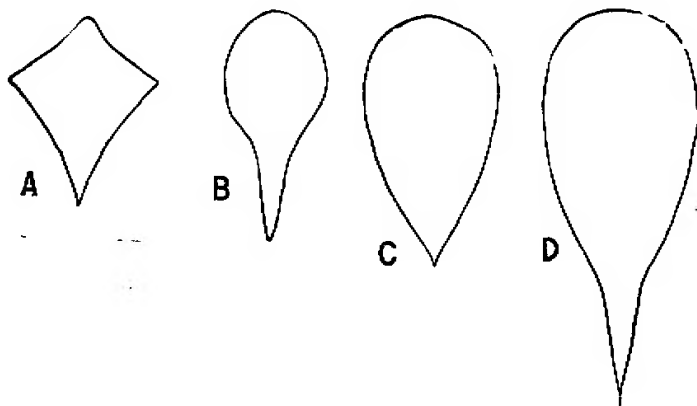


图2 中国南部黑长臂猿4亚种雌性冠斑的形态

Fig. 2. The female crown patches of four subspecies of *Hylobates concolor* in southern China

A. 指名亚种 *H. c. concolor*.

C. 海南亚种 *H. c. hainanus*.

B. 景东亚种 *H. c. jingdongensis*.

D. 滇西亚种 *H. c. fuvogaster*.

Dao Van Tien (1983) 曾以被毛的长短差异和栖居地海拔高度的不同为据将越南北部的黑长臂猿分为两个亚种, 即红河西岸的指名亚种 *H. c. concolor* 和红河东岸的海

南亚种 *H. c. hainanus*。从云南南部红河两岸(绿春和建水)的标本看,毛被的长短和栖居地的海拔高差与指名亚种似无差异,毛色和冠斑特征基本一致,显然不应为不同亚种。因此,我们认为越南北部红河以东的黑长臂猿可能不是海南亚种,似应为指名亚种。

李致祥等(1983)曾将云南中部哀牢山的黑长臂猿也划归指名亚种,但从我们在该地森林中见到的活动物和当地干部提供的两张黑白照片以及猎民的反映,这一地区的黑长臂猿体型较大,毛色更灰,雌性头顶冠斑较小,胸腹部黑色毛极少,可能是一新亚种,但迄今尚无实据标本,暂仍列为这一亚种。

地理分布:云南南部把边江以东的红河流域(建水、绿春、金平、屏边、河口),向北可能见于滇中哀牢山。南至越南北部。

(2) 海南亚种 *H. concolor hainanus* Thomas, 1892

*Hylobates hainanus* Thomas, 1892, *Ann. Mag. Nat. Hist.*, 9:145 (模式标本产地:海南岛); Pocock, 1905, p. 169—180.

*Hylobates pileatus*, Swinhoe, 1870, *Proc. Zool. Soc.*, p. 224.

*Hylobates concolor concolor*, Allen, 1938, Vol. I, p. 309; Ellerman & Morrison-Scott, 1951, p. 212; 黑田长礼, 1940, 10:156.

*Hylobates concolor hainanus*, Groves, 1972, p. 546; Dao Van Tien, 1983, p. 367; 徐龙辉等, 1983, p. 314.

鉴别特征:体型较指名亚种为小。雄性冠毛不著。雌性除冠斑黑色外,余均为棕黄色。眶上嵴较发达。

分类讨论:海南黑长臂猿以其体型较小,眶间相对较窄,雄性直立冠毛不显著。雌性体色棕黄,胸腹部无黑色。两性后肢与前肢的相对指数较大(70.4%)而与越南北部和云南南部的指名亚种有明显差异(表3)。因多数学者主张应为另一独立亚种即海南亚种 *H. c. hainanus* (Pocock, 1905; Groves, 1972; Dao Van Tien, 1983; 徐龙辉等, 1983)。我们也同意这一意见。

地理分布:本亚种仅分布于海南岛。

(3) 景东新亚种 *H. concolor jingdongensis*, subsp. nov.

正模 (Holotype) KIZ 012, 1 ♀ (老成), 1957年10月7日采自云南中部景东温卜(海拔1800m)(无量山区)。

副模 (Paratype): 3 ♂♂ (成), (KIZ 013, 024, 640289); 3 ♀♀ (成), (KIZ 050, 106, 640290)。分别于1957年10月和1964年8月采自景东无量山温卜和磨刀河(海拔2300m)。

本文所有模式标本均保存于中国科学院昆明动物研究所。

鉴别特征:头骨较指名亚种略大,颅全长114.8(111—117)。雌性体毛亮金黄褐色,头顶冠斑褐黑色,蝌蚪状(图2, B),毛长而厚密。

描记:毛被长而厚密,体背毛长60—90,雄性冠毛直立而长,毛长约50—65。两性异色,雄性通体亮黑色。雌性体背、头侧、颈背及四肢均为亮金黄褐色。略染红黄色调。四肢染有少量黑褐色。老年个体面部和喉部灰白色。胸腹部具稀而长的黑褐色毛,毛基1/3—1/2为黄灰色或粉红色。冠斑较小,形似蝌蚪状(图2, B),色褐黑。

表3 中国南部黑长臂猿的亚种比较

Table 3. The characteristics of four subspecies of *Hylobates concolor* in southern China

项目 Item	种名 Specific name	指名亚种 <i>H. concolor concolor</i>	景东亚种 <i>H. concolor jingdongensis</i>	滇西亚种 <i>H. concolor fuvogaster</i>	海南亚种 <i>H. concolor hainanus</i>
体重 Body weight		7.7—10.0	6.9—8.7	5.0—8.0	5.8—10.0
冠毛 Crown hair		显著 Marked	居中 Medium	居中 Medium	不显著 No marked
雌体冠斑大小 Crown patch size in female		居中 Medium	较小 Lesser	最大 The biggest	较大 Bigger
雌体冠斑色 Colour of crown patch in female		黑 Black	黑褐 Black-brown	亮深黑 Light darkbrown	黑 Black
耳毛 Ear hair		短少 Short & less	短少 Short & less	长而多 Long & more	短少 Short & less
脸周 Face-ring		无灰白毛 No grey-white	灰白毛多 Grey-white more	灰白毛少 Grey-white less	无灰白毛 No white
雌体背色 Back colour in female		浅黄 Pale yellow	亮金黄 Golden-yellow	灰黄褐 Grey yellowbrown	棕黄 Brown-yellow
雌体胸腹色 Chest & belly colour in female		黑毛多而短 Black hair more & short	黑毛稀而长 Black hair few & scattered	黑毛长而密 Black hair long & thick	无黑毛 No black hair
雌体四肢 On limbs in female		黑毛少 Black hair few	黑毛少 Black hair few	黑毛多 Black hair more	无黑毛 No black hair
雌体腋毛 Armpit hair in female		无黑毛 No black	无黑毛 No black	具黑毛 With black	无黑毛 No black
耳长 Ear length		28	30—37	—	34—40
(a/b%)*		67.2	74.3	—	70.4
颅全长 Greatest length of skull		111—113	111—117	—	102—105
眶间宽 Interorbital breadth		14	10.4—15.2	—	10.4—10.7
颧弓宽 Zygomatic width		78	72—75	—	66—67
后头宽 Mastoid width		72	67—70	—	64—67

\*：后肢(a)/前肢(b)指数。



头骨和牙齿与指名亚种相似，唯量度较大。

量度：

标本号 Registry number	性别 Sex	体 重 Body weight	体 长 Head & body	后 足 Hind foot	耳长 Ear	前 肢 Fore limbs	后 肢 Hind limbs
Holotype							
012	♀	7300	505	145	35	680	540
Paratypes							
640289	♂	8700	540	150	30	650	510
013	♂	—	—	—	—	—	—
024	♂	6900	430	135	30	550	430
050	♀	7500	500	145	30	620	450
106	♀	7800	468	142	37	660	480
640290	♀	7200	520	165	30	690	470

标本号 Registry number	颅 全 长 Greatest length of skull	脑 颅 长 Braincase length	眶 间 宽 Interorbital breadth	颧 弓 宽 Zygomatic width	臼齿横宽 Width across molars	腭 长 Palatum length	后头宽 Mastoid breadth	上 齿 列 Upper tooth row (I <sup>1</sup> -M <sup>3</sup> )
Holotype								
012	117	90	15	74	37	42	69	42
Paratypes								
640289	—	85	10	72	35	45	70	—
013	116	88	11	75	37	39	70	44
024	112	84	11	—	35	39	69	42
050	117	89	12	72	34	40	69	40
106	111	82	12	72	33	43	67	40
640290	116	85	12	75	33	44	70	41

分类讨论：云南中部景东无量山区的黑长臂猿，李致祥等（1983）曾作为指名亚种。但经比较，发现它们的毛被较云南南部的指名亚种远为厚密绒软。雄性冠毛相对较长。雌体背毛亮金黄褐而稍带暗灰色调，胸腹部黑褐毛较指名亚种为少。冠斑褐黑而非亮黑色，状似蝌蚪而非方棱形。头骨量度略大于指名亚种和海南亚种（表3）。据此，应为另一新亚种。

地理分布：云南中部景东无量山区。

(4) 滇西新亚种 *H. concolor fuvogaster*, subsp. nov.

正模 (Holotype); KIZ 830071, 1 ♀ (成), 1983年12月采自云南西部沧源勐来窝坎大山东坡 (海拔2000m)。

副模 (Paratype); KIZ 830038, 1 ♂ (成), 1983年12月由卫泥若采自正模标本产地。

鉴别特征: 雄性体毛暗黑色, 针毛较短。雌性胸腹和腋下全黑, 前后肢肘膝部各具一束黑色长毛。冠斑特大 (90×180), 呈卵圆形并带一尖削的尾部 (图2, D)。

描记: 雄性头顶冠毛不明显。通体暗黑色。体背毛长45—60。雌性灰黄褐色, 体背毛长65—70, 脸周灰白色较浓。头顶冠斑特大, 几遮盖整个头顶, 向后逐渐尖削呈尾状延伸至颈背中后部。肩背中央具一灰褐色区域。耳周具较多的黑色长毛。胸腹部、腋下均为浓密的亮黑色。四肢内侧黑色成份较多, 肘部和膝部各具一束黑色长毛。

分类讨论: 澜沧江以西云南西部沧源地区的黑长臂猿显然有别于各已知亚种。它与景东亚种和指名亚种比较, 雄性头顶直立冠毛不显著, 雌性冠斑特大, 几遮盖整个头顶。胸腹部为亮黑色与雄性胸腹部色近似。四肢黑色成份更多, 肘、膝各有一特殊的黑色长毛束。雌性背色较指名亚种更灰褐。体型较小, 成体体重5—8公斤。

黑长臂猿大陆各亚种间的分化主要表现在外型、毛色和冠斑形态的变化等方面。尽管目前尚无完整头骨佐证, 上述特征也足以证明沧源地区的黑长臂猿当属一新亚种。

地理分布: 黑长臂猿和白颊长臂猿通常不见于澜沧江——湄公河以西。本亚种是这两个种唯一分布到澜沧江以西的亚种。李致祥等 (1983) 曾报道保山瓦窑的4个黑长臂猿标本亦分布到澜沧江西岸。但这些标本的确切采集地点尚未明确肯定, 其胸腹部少黑, 与沧源标本有一定差异。是否归入本亚种尚待进一步查实。此外, 据云南灵长类实验中心的杨德华称, 泸水和保山地区的怒江河谷亦有黑长臂猿分布, 亦尚待今后获得标本再定。就目前所知, 本亚种仅分布于云南西部沧源和耿马一带。

(二) *Hylobates* 亚属 本亚属现知共有5种, 主要分布于中南半岛南部、马来半岛和印度尼西亚。中国仅发现一种, 即白掌长臂猿 *Hylobates lar* (Linnaeus), 1771。这一亚属所有长臂猿的染色体二倍体数目 (2n) 均为44。

白掌长臂猿云南亚种 *H. lar yunnanensis*, subsp. nov.

*Hylobates lar carpenteri*, 李致祥等, 1983, 动物学研究, 4(2):116—117。

正模 (Holotype); KIZ 640219, 1 ♂ (老成), 1964年5月19日采自云南西南部的孟连腊福, 海拔2000m。

副模 (Paratype); 2 ♂♂ (成), KIZ 03148, 640223; 1 ♀ (幼), KIZ 640224。1964年5月和11月分别采自正模标本产地, 海拔1900—2000m。

鉴别特征: 雌雄同色 (具暗色和淡色两型) 体背毛长120—150, 亮色毛基短, 为毛长的1/10至1/5。阴毛黑棕或红棕色。

描记: 毛色无性别差异。暗色型体毛黑褐, 淡色型体毛淡黄白。两型的亮色毛基均较短, 很少超过毛长的1/3。淡色型个体的喉、颈下、四肢内侧及胸腹部毛色略微深暗, 呈淡褐色。体背毛长为各亚种中最长者。臀部左右各具一胼胝。暗色型阴毛黑棕, 淡色型阴毛红棕。头骨短圆。眼眶大而眉嵴发达。

量度：

标本号 Registry number	性别 Sex	体 重 Body weight	体 长 Head & body	后 足 Hind foot	耳 长 Ear length	前 肢 Fore limbs	后 肢 Hind limbs
Holotype							
640219	♂	5.0	505	106	32	630	480
Paratype							
63148	♂	—	375	125	30	—	—
640223	♂	3.9	370	120	30	—	—
640224	♀(幼)	2.0	306	100	25	—	—

标本号 Registry number	颅全长 Greatest length of skull	脑颅长 Braincase length	眶间宽 Interorbital breadth	颧弓宽 Zygomatic width	臼齿横宽 Width across molars	腭 长 Palatal length	后头宽 Mastoid breadth	上 颌 列 Upper tooth row (I1-M3)
Holotype								
640219	105	78	11	65	32	40	70	43
Paratype								
—	—	—	—	—	—	—	—	—

分类讨论：李致祥等（1983）将云南南部孟连的白掌长臂猿并入泰国西北部（清万一带， $15^{\circ}$ — $18^{\circ}$ N.）的 *H. l. carpenteri*，作为国内亚种新纪录报道。经比较，孟连标本明显不同于已知四亚种。泰北亚种 *H. l. carpenteri* 为灰奶油白色，暗色型的亮色毛基通常超过毛长的1/2，且阴毛白色。孟连标本的亮色毛基极短，仅1/10或1/5左右，阴毛均为黑棕或红棕色，故两者显然有别。马来亚的指名亚种 *H. l. lar* 的淡色型为乳白色，近于白色，苏门答腊的 *H. l. vestitus* 呈亮金黄褐或皮黄色，冠部和腹部具暗色斑块，而中南半岛的 *H. l. entelloides* 则为皮黄或蜜黄色，暗色型的毛基较浅亮，一般为毛长的1/3。这些特征都与孟连标本不符。就体背毛长而论，*lar*，*vestitus*，*entelloides* 三亚种多在29—56之间，*carpenteri* 在79—103之间（Groves, 1968），而孟连标本为110—150左右。综上所述，其差异显著，当属新亚种。

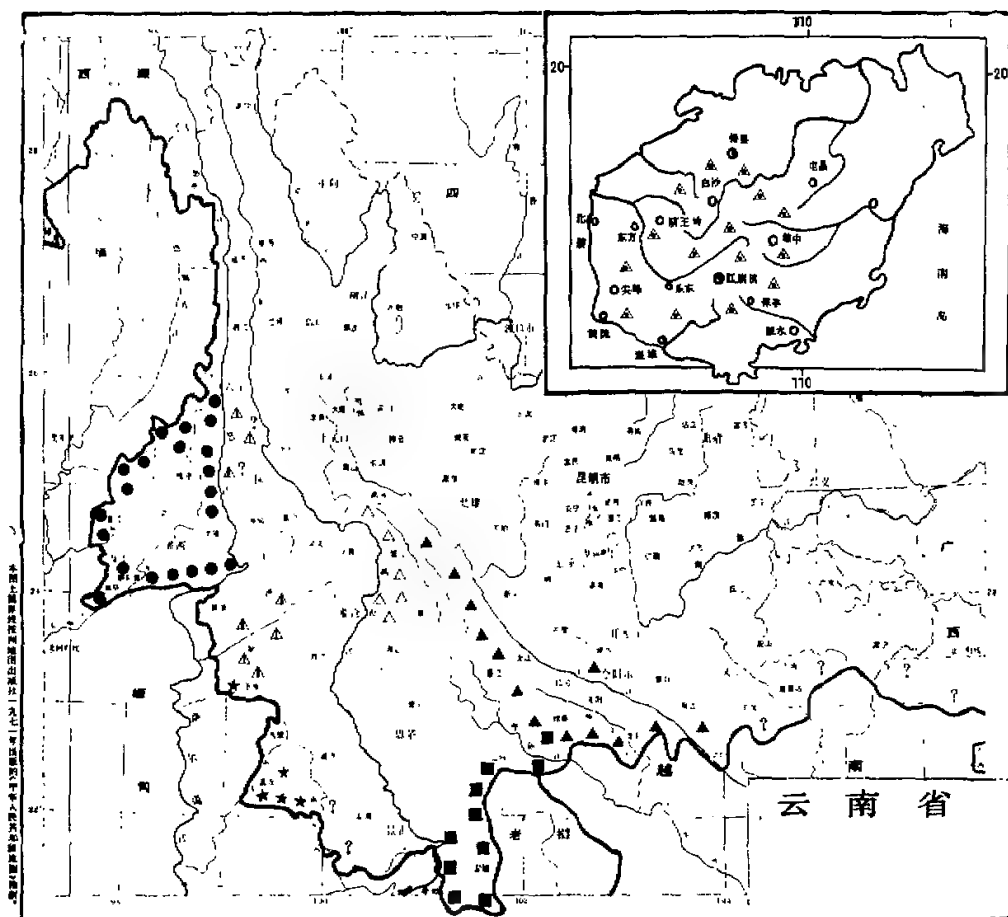
地理分布：该新亚种现仅见于云南西南部的孟连（腊福）、西盟至沧源的单甲、斑洪、斑老、南腊（芒卡）等中缅边境一带。

（三）*Bunopithecus* 亚属 该亚属系 Prouty *et al.* (1983) 根据染色体二倍体数目 ( $2n$ ) = 38 而建立的一个新亚属。迄今为止，本亚属仅记载过一种——白眉长臂猿 *Hylobates hoolock*。

白眉长臂猿 *Hylobates hoolock leuconedys* Groves, 1967

*Hylobates hoolock*, Allen, 1938, *Amer. Mus. Nat. Hist.*, 1: 306. (云南西部红木树，南定河)，全国强等，1981, p. 7—14；李致祥等，1983, p. 117。

*Hylobates hoolock leuconedys* Groves, 1967, *Folia. Primatologica*, 7: 276—283. (伊洛瓦底江东部)。



云南全省地形图一九八二年版

图3 中国南部长臂猿的分布

Fig. 3. Distribution of gibbons in southern China.

- |   |                                   |
|---|-----------------------------------|
| ● 白眉长臂猿 <i>H. hoolek leuconedys</i>     | ▲ 指名亚种 <i>H. c. concolor</i>      |
| ★ 白掌长臂猿 <i>H. lar yunnanensis</i>       | △ 海南亚种 <i>H. c. hainanus</i>      |
| ■ 白颊长臂猿 <i>H. leucogenys leucogenys</i> | △ 景东亚种 <i>H. c. jingdongensis</i> |
| △ 黑长臂猿 <i>H. concolor</i>               | △ 滇西亚种 <i>H. c. fuvogaster</i>    |

鉴别特征: 雄性通体暗黑褐色。头顶无直立冠毛, 毛向向后, 因而头顶较平。两眼上方各具一道白色眉纹。阴囊毛尖白色; 雌体大部灰白, 胸腹部及头侧具暗棕色调, 脸部较宽阔。

头骨短圆。眼眶较大。颧弓纤细。犬齿较其它种长臂猿瘦弱。

标本及量度(表2)。

分类讨论: 白眉长臂猿曾长期被视为单型种。Anderson在1879年发现于我国云南西部与缅甸克钦山一带。尔后Andrews(1917)又在云南西部边境的红木树(Homushu)和南定河(Namting River)采到了标本(Allen, 1938)。昆明动物研究所亦先后在腾冲大塘冷水河获得标本而再次报道(李致祥等, 1983), 但均以单型种处理。Groves(1967)在研究伊洛瓦底江东西两岸的白眉长臂猿时发现, 江两岸的标本具明显差异, 并非同一类型。江西标本左右眉纹相连, 雄性肩背毛长25—44, 雌性48—56, 暗色型之阴毛黑色; 江东标本左右眉纹中间完全断开。两性肩背毛长30—70(云南标本为70—100), 阴毛白色, 从而将江东所产白眉长臂猿定为新亚种*H. h. leuconedys*。云南腾冲一带的白眉长臂猿与该新亚种的描述完全一致。

地理分布: 该亚种分布于伊洛瓦底江以东, 滇西怒江以西的腾冲、盈江、瑞丽及澜西勐糯。

## 中国南部长臂猿的分布

各种和亚种的分布地详列如下:

### 1. 白颊长臂猿 *Hylobates leucogenys leucogenys* Ogilby

#### (1) 勐腊县(Mengla Co., southern Yunnan)

- a. 曼粉(Mangfen, 21°04' N., 101°37' E.)
- b. 龙门(Longmeng, 20°07' N., 101°32' E.)
- c. 尚勇(Shanyong, 20°09' N., 101°43' E.)
- d. 龙林(Longling, 21°33' N., 101°28' E.)
- e. 曼帕(Mangpa, 21°40' N., 101°43' E.)
- f. 勐崙(Monglun, 21°57' N., 101°15' E.)
- g. 象明(Xiangming, 22°09' N., 101°19' E.)

#### (2) 江城县(Jiangcheng Co., southern Yunnan)

- a. 龙潭(Longtang, 22°26' N., 101°39' E.)
- b. 岩脚(Yanjiao, 22°31' N., 101°46' E.)
- c. 教刮塘(Jiaogutang, 22°26' N., 102°11' E.)

#### (3) 绿春县(Luchun Co., southern Yunnan)

- a. 黄连山(Mt. Huanglian, 22°20' N., 102°15' E.)

### 2. 黑长臂猿 (*Hylobates concolor concolor* (Harlan))

#### (1) 绿春县(Luchun Co., southern Yunnan)

- a. 黄连山(Mt. Huanglian, 22°20' N., 102°15' E.)

- (2) 金平县 (Jinping Co., southern Yunnan)  
a. 西隆山 (Mt. Xilong, 22°38' N., 102°50' E.)  
b. 分水岭 (Fenshuiling, 22°50' N., 103°20' E.)  
(3) 河口—屏边县 (Hekou-Pingbian Co., southern Yunnan)  
a. 大围山 (Mt. Dawei, 22°55' N., 103°40' E.)  
(4) 建水县 (Jianshui Co., southern Yunnan)  
a. 官厅 (Guanting, 23°20' N., 102°45' E.)  
(5) 新平—双柏县 (Xinping-Shuangbai Co., centre Yunnan)  
a. 哀牢山 (Mt. Ailao, 23°45'—24°30' N., 101°10'—101°45' E.)
- 景东黑长臂猿 *H. concolor jingdongensis* Ma et Wang subsp. nov.  
(1) 景东县 (Jingdong Co., centre Yunnan)  
a. 无量山 (Wuliangshan, 24°00'—24°50' N., 100°25'—100°50' E.)
- 滇西黑长臂猿 *H. concolor fuvogaster* Ma et Wang, subsp. nov.  
(1) 沧源县 (Cangyuan Co., west Yunnan)  
a. 窝坎大山 (Wokandashan, 23°15'—23°25' N., 99°05'—99°15' E.)  
(2) 耿马县 (Gengma Co., west Yunnan)  
a. 回汗山 (Huihangshan, 23°20'—23°30' N., 99°05'—99°15' E.)  
(3) 永德县 (Yongde Co., west Yunnan)  
a. 崇岗 (Conggang, 23°40' N., 99°29' E.)
- 海南黑长臂猿 *H. concolor hainanus* Thomas  
(1) 海南岛 (Hainan island, southern China)  
a. 尖峰岭 (Jianfengling, 18°10' N., 108°40' E.)  
b. 坝王岭 (Bawangling, 18°55' N., 109°00' E.)  
c. 五指山 (Wuzhishan, 18°50' N., 109°55' E.)  
d. 白沙 (Baisha, 18°55' N., 109°00' E.)  
e. 东方 (Dongfang, 18°50' N., 108°25' E.)  
f. 黎母山 (Limushan, 18°55' N., 109°40' E.)
3. 白掌长臂猿 *Hylobates lar yunnanensis* Ma et Wang, subsp. nov.  
(1) 孟连县 (Menglian Co., southern Yunnan)  
a. 腊福 (Lafu, 22°08' N., 99°26' E.)  
b. 昂朗山 (Mt. Anglang, 22°07' N., 99°23' E.)  
c. 哈布壳 (Habuke, 22°09' N., 99°29' E.)  
d. 富岩 (Fuyan, 22°23' N., 99°26' E.)  
(2) 西盟县 (Ximeng Co., southern Yunnan)  
a. 土克压 (Tukeya, 22°52' N., 99°30' E.)  
b. 大黑山 (Mt. Dahei, 22°54' N., 99°40' E.)  
(3) 沧源县 (Cangyuan Co., west Yunnan)  
a. 单甲 (Danjia, 23°11' N., 99°23' E.)

- b. 永和 (Yonghe, 23°07' N., 99°15' E.)
  - c. 芒回 (Manghui, 23°10' N., 99°07' E.)
  - d. 斑洪 (Banghong, 23°17' N., 99°06' E.)
  - e. 斑老 (Banglao, 23°15' N., 98°56' E.)
  - f. 南腊 (Nanla, 23°22' N., 98°59' E.)
  - g. 芒乍 (Mangka, 23°28' N., 98°55' E.)
  - h. 白岩 (Baiyan, 23°22' N., 98°56' E.)
4. 白眉长臂猿 *Hylobates hoolock leuconedys* Groves
- (1) 腾冲县 (Tengchong Co., west Yunnan)
    - a. 大塘 (Datang, 25°39' N., 98°40' E.)
    - b. 大白草坡 (Dabaicaopo, 25°30' N., 98°20' E.)
    - c. 五台山 (Mt. Wutai, 25°34' N., 98°14' E.)
  - (2) 盈江县 (Yingjiang Co., west Yunnan)
    - a. 瓦蕉 (Wajiao, 24°42' N., 97°37' E.)
    - b. 老刀弄 (Laodaolong, 24°39' N., 97°36' E.)
  - (3) 瑞丽县 (Ruili Co., west Yunnan)
    - a. 芒昌 (Mangchang, 23°59' N., 97°39' E.)
    - b. 等扎 (Dengzha, 24°04' N., 97°43' E.)
  - (4) 潞西县 (Luxi Co., west Yunnan)
    - a. 东山 (Dongshan, 24°12' N., 98°18' E.)
    - b. 黑河老坡山 (Mt. Heihelaopo, 24°13' N., 98°36' E.)
  - (5) 龙陵县 (Longling Co., west Yunnan)
    - a. 白石头山 (Mt. Baishitou, 24°18' N., 98°50' E.)
    - b. 大尖山 (Mt. Dajian, 24°17' N., 99°09' E.)
  - (6) 保山县 (Baoshan Co., west Yunnan)
    - a. 坝湾 (Bawan, 24°57' N., 98°49' E.)
    - b. 芒宽 (Mangkuan, 25°27' N., 98°51' E.)
  - (7) 泸水县 (Lushui Co., west Yunnan)
    - a. 付邦 (Fubang, 25°42' N., 98°50' E.)
    - b. 丙贡 (Bingong, 25°39' N., 98°49' E.)

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## THE TAXONOMY AND DISTRIBUTION OF THE GIBBONS IN SOUTHERN CHINA AND ITS ADJACENT REGION-WITH DESCRIPTION OF THREE NEW SUBSPECIES

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The present paper deals with the gibbons of the genus *Hylobates* existing in the southern and adjacent region of China. Altogether four species of gibbons are reported. A revision of white-cheeked gibbon (*Hylobates leucogenys*) is discussed with a description of three new subspecies.

### 1. *Hylobates leucogenys* Ogilby, 1840

This species was named by Ogilby (1840) on the basis of specimens from Thailand. Ellerman and Morrison-Scott (1951) regarded it as a subspecies of *Hylobates concolor*, then scholars all disposed of the view for a long time. But based on the following reasons we treat it as an effective species,

(1) The cheek-whiskers are white in *H. leucogenys*, while it is black in *H. concolor*.

(2) The size of  $M^1-M^3$ : *H. leucogenys* is  $M^2 > M^1 > M^3$ , while *H. concolor* is  $M^2 \geq M^1 \approx M^3$ .

(3) The penis bones, *H. concolor* is shorter and coarser (6—9 mm.), without bone projection, while *H. leucogenys* is long and thin (8—10 mm.), with bone projection.

(4) Both of them are geographically overlapped in Luchun, Southern Yunnan and Ma River region, North Vietnam (Dao Van Tien, 1983).

Distributions. There are three subspecies of this species, *H. l. leucogenys*, North Vietnam and Southern Yunnan (Mengla, Jiangcheng and Luchun), *H. l. siki*, Central Vietnam and Laos, *H. l. gabriellae*, Southern Vietnam.

### 2. *Hylobates concolor* (Harlan), 1826

This species includes *H. c. concolor*, *H. c. hainanus*, *H. c. lu* and two new subspecies.

#### (1) *H. c. jingdongensis* subsp. nov.

Holotype, No. KIZ 012, female (ad.), collected in October, 1957, from Wenbu, Jingdong, Central Yunnan (Wuliang Mountain) (alt. 1800 m.)

Paratypes: 3 males (ad.), No. KIZ 013, 024, 640289; 3 females (ad.), No. KIZ 050, 106, 640290, collected from the same date and locality as the holotype.

Diagnosis: This subspecies differs from its allies in size medium, weight 6.9—8.7 kg, always a light golden-yellow in female, the crown patch is smaller, looks like a tadpole.

Distribution: Wuliang Mountain, Central Yunnan.

(2) *H. c. fuvogaster*, subsp. nov.

Holotype: No. KIZ 830071, female (ad.), collected in December, 1983 from Menglai, Cangyan, West Yunnan (alt. 2000 m.)

Paratype: No. KIZ 830038, male (ad.), collected from same date and locality as the holotype.

Diagnosis: It differs from other subspecies of *H. concolor* in its body size being the smallest, body weight 5—8 kg, The female is dark gray in color, with very large crown patch (95×180 mm.), and with longer and thick black hairs on the chest, belly, armpits, elbows and knees.

Distribution: Distributed in the region between Salween and Mekong River, West Yunnan.

3. *Hylobates lar yunnanensis*, subsp. nov.

Holotype: No. KIZ 640219, male (ad.), collected on May 19, 1964, from Menglian, Southwest Yunnan (alt. 2000 m.).

Paratypes: 2 males (ad.), No. KIZ 03148, 640223; 1 female (yg.), No. KIZ 640224, collected in May and November, 1964, from the same locality as the holotype.

Diagnosis: It differs from *H. l. lar*, *H. l. vestitus*, *H. l. entelloides* and *H. l. carpenteri* in its shorter light hair-bases (only reaching 1/10 or 1/5 the length of the hair), longer hairs on the back (120—150 mm.), and the pubic hairs are usually dark brown or red brown.

Distribution: From Menglian to Cangyuan, China-Burma border region, West Yunnan.

4. *Hylobates hoolock leuconedys* Groves, 1967

It was a new subspecies separated from *hoolock* by Groves (1967). In which, the black phase has a white genital tuft and the white browstreaks are well separated. The specimens from Yunnan is consistent with the characters of *H. h. leuconedys*.

Distribution: East of the Chindwin River and Tengchong, Yengjang, West Yunnan.

The holotypes and paratypes of the above-mentioned three new subspecies are kept in Kunming Institute of Zoology, Academia Sinica, Kunming.

Through on-the-spot investigation, however, we think that there is no *Hylobates syndactylus* in Cangyuan, West Yunnan, China.

**Key words** Gibbons Taxonomy New subspecies Southern China

## A PRELIMINARY STUDY OF THE TAIWAN MACAQUE (*MACACA CYCLOPIS*)

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**ABSTRACT:** Taiwan macaques are a relatively unknown species. Prior to Poirier's 1978 study, no systematic fieldwork had been attempted. No fieldwork has been done since 1978. During the field study, Poirier spent 31 days in various mountainous regions surveying the macaque population. Additional time between June and November, 1978 was spent observing a troop of Taiwan macaques at the Tai Pei Zoological Gardens, as well as conducting interviews with animal dealers, local trappers, and aboriginal hunters. This article discusses the survey results, some aspects of social organization and behavior, and ecology.

### ECOLOGICAL SETTING

Taiwan is basically a subtropical environment. However, because of a mountain system which consists of several more or less parallel peaks, there is a great deal of climatic and ecological diversity (Li, 1963; Peirse, 1969). The eastern mountains fall sharply into the sea, leaving little or no plain. Mountains in the western part of the island fall less steeply and there is a plain 50 km. at its widest, in some places flat and in other places interspersed with small hills. Much of the land below 100 m. elevation is very fertile and cultivated, however, higher regions are generally unsuited for agriculture.

The steep and very rugged Central Range forms the backbone of the island and has 60 peaks exceeding 3,000 m. The Yu Shan range lies west of the Central Range and contains Yu Shan which, at 3,900+m, is the highest peak in eastern Asia. Further west is the Ali Shan Range, a plateau-like group with elevations varying from 1,000—2,800 m. The Coastal Range is very rugged and, because of sparser human habitation, is home for the highest concentrations of macaques.

Vegetation: Taiwan was probably originally covered with forest before

extensive human alteration, mainly agricultural pursuits which converted most lowlands, foothills, and many higher elevations to agriculture. Within the past 70 years, logging has devastated the higher slopes which contain economically valuable species. Never the less, some higher elevations still contain beautiful primeval forests sheltering valuable wildlife. Strong government preservation policies will ensure that these regions remain intact.

Altitude variations result in different faunal and floral communities (Table 1). Lowlands contain tropical Asian elements, and at lower altitudes the flora is closely aligned with that of Mainland provinces. The mountain flora shows a relationship to western China, while high alpine regions reflect the Sino-Himalayan region. As noted in Table 1, monkeys are more likely found in some vegetational zones than in others.

Table 1. Forest Types of Taiwan

Type	Elevation	Composition	Presence of Monkeys
Tropical Forests			
Old World tropical growth	Coastal regions	Old World tropical growth	none or few
Tropical rainforests	Lowlands/foothills	vines, epiphytes	present
Sub-tropical Forests			
sub-tropical rainforests	Up to 1,800 m.	broad-leaf forests, hardwoods, conifers, bamboo, woody vines, dense undergrowth, tree ferns, orchids	present
Temperate Forests			
Temperate forests	1,800—2,500 m.	conifers mixed with deciduous broad-leaf trees	present
Conifer forests	2,250—3,000 m.	Taiwan fir, scattered spruce	present, scattered
Frigid			
Shrub, Fir	3,000 m.	shrubs, fir, herbaceous plants	few, scattered

Environmental variables. Given the wide array of situational conditions on Taiwan, environmental variables yield differing floral compositions (Wang, 1962). The natural elements affecting floral and faunal diversity include, temperature, rainfall, aspect, elevation, and landslides. Humans are the greatest biotic factor affecting vegetation and leave their mark in many ways. Aboriginal populations gradually increased through time, changing their attention from a decreasing faunal complement to shifting cultivation of millet and potatoes,

This cultivation significantly altered the character of large forest tracts and affected resident wildlife. Recently, a rapid population increase and disruptions have been followed by expansion of farm lands from lowlands upwards to the mountain slopes. The forest, largely of secondary growth in the foothills, has repeatedly been ruined.

Logging, a far greater destructive force, has occurred in the cypress forests for more than 70 years and has all but eliminated them except in higher and in accessible regions. Damage to such forests is so extensive that it prevents return of the original growth.

### LITERATURE REVIEW

Little has been written about the Taiwan macaque. While there are some studies on ectoparasitic infection, on reproductive biology, and anatomy, there is minimal behavioral and ecological data. One brief report on the macaque was written by Kuroda (1940). In 1973 McCullough (1974) made a brief survey of the status of the larger mammals on Taiwan and included some information about the monkeys. The only other behavioral information appears in Poirier (1982) and Poirier and Davidson (1979).

### PHYSICAL DESCRIPTION

The Taiwan macaque belongs in the taxon *Macaca cyclopis* (Swinhoc, 1892) and is related to other species of Asian *Macaca*. The Taiwan macaque superficially shows its closest physical relationship to Japanese (*M. fuscata*) and Indonesian long-tailed (*M. fascicularis*) macaques. Taiwan macaques are large, adult males may weigh upwards of 22 kgs. The major difference between Japanese and Taiwanese macaques is the latter's longer tail, lighter facial and buttocks coloration, and the darker color on the bottom of the limbs.

Taiwan macaques have a thick dark brown hair coat. The buttocks are a light reddish color or purple-greyish according to Peng, *et al.* (1973 a, b). Hair on the limbs appears darker than hair on the remainder of the body, and there is a black line on the dorsal tail surface. The tail is approximately one-third of a meter in length.

There is notable sexual dimorphism. Females are smaller than males. Adult females have a prominent sexual skin and multiparous females have pendulous breasts. The male's skull reflects larger musculature and the male's canine teeth are approximately twice the size of those of the females.

The head is round and the face flat. The hair on the top of the head is not particularly conspicuous. Facial coloration is of various shades of red

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surrounded by whitish hair. Facial coloration varies with age and reproductive condition. Variation in facial coloring may be the basis of some native reports of different kinds of monkeys on Taiwan. Cheek pouches are evident and used for food storage. Eyelids have a faint bluish tint. The stomach has a bluish-grey or whitish-grey tint and the hair about the anus is white. Young animals have a greyish hair coloring rather than the dark brown adult color.

There are a number of reports of albino monkeys in different parts of Taiwan, confirmed some of these reports.

### METHODOLOGY

Many factors affected the implementation of this study. Taiwan's mountain system is especially treacherous. Added to the dangers of landslides and fog-obscured vision resulting in directional dislocation, was the presence of five species of poisonous snakes and the possibility of an occasional lethal bear trap. Considerable lead time and consultation were needed before embarking on a trip of any duration. Weather was an irritant because much of the study occurred during the typhoon season, extending into November. Travel to and from field sites consumed considerable time.

Table 2 summarizes the kinds of information collected.

Table 2. Information Sought and Collection Method

Information Sought	Collection Method
Birth periodicity	Interviews in field and laboratory, interviews with animal dealers concerning supply of animals
Daily routine	Direct observation, interviews with trappers
Elevation distribution	Direct observation, interviews
Feeding habits	Direct observation, analysis of fecal remains, interviews
Group size and composition	Direct observation, interviews
Habitat alteration	Direct observation, interviews
Habitat use	Direct observations, interviews
Population change	Interviews, consulting previously published information

Selection of study sites was motivated by the desire to sample different habitats in as many locales as possible. Sites were chosen in northern, central, eastern, southern, and western Taiwan. Site selection was made with the help of local informants, and as often as possible based upon recent sightings of monkeys. Transportation was an important factor in the final choice of study

sites. Despite these and other restraints, a fairly representative habitat sampling was made. Future studies will obtain more and better data by concentrating on Tai Ping Shan in the northeast and many areas in the eastern Coastal Range. A survey is needed of some areas east and south of Tai Nan. A fuller description of the areas surveyed is found in Poirier and Davidson (1979).

Surveys included long periods of hiking and extensive driving. Extensive interviews were conducted with forest personnel, animal trappers and aboriginal hunters—who were all most helpful. A trained botanist was often part of the field team.

A daily manual of weather and plant conditions was maintained. As much as possible the faunal and floral content of each habitat was classified. Stool samples were visually examined when available.

Social interactions were noted by recording the time, place, duration and participants. Because animals were not under constant observation, individual identification was not attempted. Ages and sexes of the interactants was noted. Daily movement and activity patterns were recorded. Photographs were taken to assist in interpretations.

### POPULATION DYNAMICS

**Birth periodicity:** There is strong evidence for birth periodicity among Taiwan macaques. Evidence points strongly towards birth peaks, distinct periods of the year when most births occur. Because females give birth only once a year, and probably only to one infant each 18–24 months, there is also a mating season.

Birth periodicity is most often associated with changing patterns of rainfall, temperature, humidity, and number of daylight hours. All these factors affect vegetational growth. There is also mounting evidence that birth periodicity is influenced by group traditions. Groups within the same habitat may have slightly different birth periods that may be related to group traditions.

The evidence collected in this study suggests that births are concentrated in the months of March to October, with the highest incidence from May to July. Attempts to relate these births to environmental variables were not fruitful, probably because of insufficient data.

Based on data from laboratory animals, Peng, *et al.* (1973a, b) report a birth peak from March to May. They consider the breeding season in the wild to extend from the end of September to January.

**Sexual behavior:** Sexual behavior was not witnessed. However, several captive females revealed clear signs of estrous. Females have a prominent sexual

skin extending from the anal-genital region down across the thighs. This area swells at ovulation and is a clear sign of sexual readiness. As reported in other macaque species, the facial coloration of female Taiwan macaques changes slightly in accompaniment with estrous.

Peng, *et al.* (1973a, b) provide a considerable amount of data concerning Taiwan macaque reproductive biology, which shows many similarities to that of the Indian rhesus macaque.

**Troop size and composition:** Taiwan macaque troop sizes vary from 10—50 animals. Because of many observational difficulties, did not get a clear picture of Taiwan macaque troop composition. However, these are multiple adult male and multiple adult female social groups. Although the ratio of mles to females is unknown, troops contain more adult females than adult males. Another trait of the Taiwan macaque's troop structure is the presence of juvenile subgroups, bisexually organized social aggregates containing animals of similar age. Such subgroups appear to move, feed, and play together.

A number of sightings suggested the presence of solitary or peripheral animals, usually these were adult males.

#### FOOD AND FEEDING BEHAVIOR

As is obvious from Tables 3 and 4, Taiwan macaques are basically vegetarians. They apparently also consume some insects and fresh-water libe (Mc Cullough, 1974). There is no evidence that they consume eggs of the various avian species with whom they share a habitat. Fecal samples contained only fibrous plant materials and undigested seeds.

The diet varied seasonally, animals visit certain trees and plants at different times in the annual fruiting and flowering seasons. The macaques visited the same areas year after year, indicating a stable home range. Most favored feeding trees, such as *Machilus* and *Schima*, are connected by well-worn travel paths, attesting to the fact that the animals regularly favor certain trees. Feeding usually occurs during the earlier morning and later afternoon hours.

Animals feed both on the ground and in the trees. Many of the favored *Rubus* vines are ground-growers. Scanty data suggests that ground foods are taken earlier in the morning. If this is true, it may be an interesting predator avoidance mechanism.

Macaques also eat such cultigens as corn, millet, sugar cane, bananas, and oranges. It is not known if the Taiwan macaque has developed any of the particular behavioral patterns commonly associated with other crop-raiding monkeys (Poirier, 1969, 1970a, 1977a). Some of the cultigens eaten are



relatively new dietary items and are only eaten when farmers plant the crops. Some naturally-growing foods, such as *Miscanthus*, may be relatively new dietary items. In some sites surveyed *Miscanthus* is a new plant, colonizing an area subsequent to forest fires and/or landslides.

Squirrels and monkeys may compete for some of the same foods in both broadleaf hardwood and conifer forests. In such a situation, squirrels outcompete the monkeys. Humans deprive the macaques of traditional food supplies through forest destruction and by commercially exploiting such plants as the passion fruit and the mushroom.

### COMMUNICATIVE BEHAVIOR

The only social behavior on which I collected any amount of information was communicative behavior. The defined communicative elements are given in Table 5. A full description of each of the communicative elements appears in Poirier and Davidson (1979). The Taiwan macaque's vocal repertoire sounds very similar to that of rhesus and long-tailed macaques. Taiwan macaques have at least three major classes of vocalizations, the bark, vocalizations on a screech-scream continuum, and a high-pitched warning bark. The vocal system is an integration of sounds with the intensity of the sound across the spectrum seemingly determining reactions. Sounds at different ends of the spectrum are distinguishable according to context, as well as by intrinsic qualities of the vocalizations themselves.

### HOME RANGE, CORE AREAS, TERRITORIALITY

The home range is that area crossed during the normal activities of food gathering, mating, and caring for the young. The home range is usually constant over time and does not include areas crossed on occasional long travel of possibly an exploratory nature. The home ranges of the Taiwan macaque appear to be quite stable over time. Although the size of the home range is not known, the monkeys utilize an area on a seasonal basis to exploit various flowering/fruiting cycles. In areas where favored foods are heavily concentrated, the monkeys remain sedentary and deplete a food source before moving to another area.

Animals use the home range on a vertical basis. They move higher into the mountains in spring and summer to take advantage of seasonal foods offered there. In the colder winter months, when snow appears at higher elevations, they apparently move lower in the home range. This is when they are most likely to raid cultivated crops.

Those parts of the home range that are most frequently utilized are called

Table 3. Food Sources of Taiwan Macaques

Food	Part eaten	Information source
<i>Actinidia chinensis</i> (1)	seeds, fruits	saw food remains
<i>Alnus</i> spp.	seeds	informant
Bamboo shoots	young shoots	informant
<i>Castanopsis longicaudata</i> (2)	acorns	informant
Cultivated crops	sugar cane, potato, orange, millet, banana, papaya	informant
<i>Diospyros sasaki</i>	fruit	saw food remains
"dragon eye" (Longan) (3)	fruit	informant
<i>Ficus pumila</i>	cones or seeds, fruit	informant
<i>Gaultheria bornensis</i>	berries	McCULLOUGH
insect and fresh water forms	locusts, molluscs, crustaceans	KURODA
<i>Lithocarpus amygdalifolius</i> (2)	acorns	informant
<i>Litsea cubeba</i> (3)	berries	saw food remains
<i>Machilus</i> spp. (4)	seeds	informant
<i>Malus formosana</i>	fruits	informant
<i>Miscanthus sinensis</i> (5)	stalk, pulp, shoots	informant, McCULLOUGH
Mushrooms		informant
<i>Nephelium longanum</i>	fruits	KURODA
Passion fruit (6)	fruits, seeds	saw food remains
<i>Polygonum cuspidatum</i>	seeds	personal observation
<i>Pratia nummularia</i>	fruits	saw food remains
<i>Quercus</i> spp. (2)	cones	informant
<i>Quercus morii</i>	acorns	informant
<i>Rubus</i> spp.	fruits	informant, found in fecal remains
Sassatras	berries	informant
<i>Schima superba</i> (7)	berries	saw food remains
<i>Stonea dasycarpa</i>	fruits	informant
<i>Symplocos</i> spp.	berries	informant
"Taboo tree" (8)	fruits (June/July)	informant
Tree bark		informant
<i>Trema</i> spp.	young leaves	informant
Unidentified plant (9)	fruit	personal observation

- (1) Terrestrial vines with fruits. Monkeys break open the fruits and scrape out the sweet, jelly-like inside with incisors. A slight sour taste.
- (2) Some competition with squirrels for these food sources.
- (3) Berries have a medicinal taste at first and burn the tongue. Pleasant aftertaste. Apparently edible only when berries are dark purple, i. e., when ripe.
- (4) A favored food plant in almost all areas where it appeared.
- (5) Peel off the outer covering with hands and incisors to get the pulp. Pulp is tasteless. A colonizer of burnt-over and landslide areas. May be a relatively new addition to the diet in some areas.
- (6) Appear to scrape the skin off with the incisors and eat the pulp.
- (7) A favorite food at Amma Shan. Squirrels also eat this food. Break off the twigs in feeding.
- (8) Native terms for the trees. Botanical name unavailable.
- (9) Grows on a thorny terrestrial vine. Fruits resemble tomatoes.

Table 4. Distribution of Food Items

Part Eaten	Number of food sources providing dietary items
seeds, fruits, cones, berries, acorns	24
cultivated crops	6
shoots	2
stalk/pulp	1
leaves	1
bark	1

Table 5. Communication Matrix of the Taiwan Macaque

Communicative Act	Situation	Source of Information
Vocalizations		
alarm/warning bark	on encounter	direct observation, field
lip-smack	submission	field and captive observations
semi-whistle	excited, fright	captive observations
squeak/squeal	fright	captive observations
food call	on seeing food	captive observations
gecker	unclear	field observations
mew	infant on loss of mother contact	field and captive observations
Gestures/Postures		
branch-shaking	excitement, threat, play	captive and field observations
Dominance/Threat		
bouncing walk	follows dominance encounter	captive observations
displacing	mild dominance	captive observations
eye-lid threat	mild threat	captive observations
head bob	threat	field and captive observations
mounting	dominance	captive observations
stare	threat	captive observations
stiff-legged stance	dominance	field and captive observations
tail up	dominance (?)	captive observations
yawn	threat, uncertainty	captive observations
Submission		
lip smack	mild submission	captive observations
look-away	mild submission	captive observations
presenting	submission	field and captive observations
Displacement Activities		
scratching, urination defecation, yawn	excitement	field and captive observations
Others		
lip-smack	grooming	field and captive observations
play mouth	play	captive observations
presenting	grooming	captive observations

the core areas. These areas contain sleeping trees, resting sites and preferred food sources. Travel is concentrated within the core area. While home ranges of neighboring troops may overlap, core areas are seldom shared. Although collected no concrete information, assume that a Taiwan macaque group has a core area.

It is not known if Taiwan macaques are territorial.

### CONSERVATION

A fuller report of the conservation needs of the Taiwan macaque appears in Poirier (1982, 1984) and Poirier and Davidson (1979). The major human impact upon Taiwan macaques comes from forest destruction. This confirms the statement made by the International Primatological Society's 1979 Report on Conservation that habitat destruction and population pressures are the main concerns in preserving Asian primates.

McCullough (1974) estimated that about 200 macaques were sold each year. Peng, *et al.* (1973a) reported that about 960 macaques were consumed annually for such things as medical research, skeletal preparation, and Chinese medicine. Based on data collected from hunters and trappers and from animal dealers, suggest that a figure of 1,000—2,000 animals taken annually is a better estimate. This figure was generated by taking the number of Taiwan macaques counted in animal shops (29), the number of observed captives (10), and the averages of the number of animals sold each year in the five shops providing figures (863).

In recent years Taiwan has made commendable efforts towards furthering wildlife preservation. Since the total ban of hunting was made in 1973, there has been an apparent increase in some wildlife. While hunting and trapping must be regulated, the most important variable in any conservation scheme is habitat protection and management. The major recommendation to be made based on the 1978 study is that the hardwood forests must be carefully protected and logging carefully controlled. Protected areas must include vertically distributed mountain forests because the monkeys seasonally migrate from lower to higher levels.

It is not too late to effectively manage the Taiwan monkey population. Given the local situation, effective management must allow room for competing interests, e. g. the logging industry, the animal trade, aboriginal hunting, and possible export for scientific research. One goal, however, must remain foremost, the preservation of Taiwan's unique monkey population.

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